

Notes on Fungi. I.

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In my paper on *Peronosporæ* (BOTANICAL GAZETTE, viii. 335), the statement was made that the *Cystopus* parasitic on *Convolvulacæ* in the United States was apparently the same as the *Æcidium Ipomææ-panduranæ* of Schweinitz, *Syn. Fung. Car. Sup.* no. 454, and a doubt was expressed as to whether it should be united with the *C. cubicus* (Strauss) Lev. which infests *Compositæ*, although the conidia of the two forms are much alike. At that date the oospores of the form on *Convolvulacæ* had not been seen, and I suggested that they should be sought in the stems and petioles rather than in the leaves. In the autumn of 1888 I received from Prof. L. H. Pammel some very interesting specimens of swollen stems of *Ipomæa pandurata*, collected at Valley Park, near St. Louis, Mo., in which he had found the oospores in abundance, while the accompanying leaves were covered with conidia. The swellings of the stems were very striking, and in one fine specimen the tumor formed by the hypertrophied parenchyma of one side of the stem was six inches long and somewhat over an inch in diameter, while the stem itself, whose diameter was not greater than a quarter of an inch, was bent over in the form of a horse-shoe by the growth of the unilateral tumor. The surface of the tumors when fresh was continuous, but in drying they cracked open and the inner portion was exposed in numerous places. Microscopic examination showed that the oogonia were different from those of any other *Cystopus* known to me, since their walls were not smooth, but raised in blunt papillæ, or short flexuous ridges over their whole surface. In the younger oospores the smooth-walled antheridia were in marked contrast with the papillate oospores, and the pollinodia were larger and more prominent than in other *Peronosporæ*, so that the present species is remarkably well adapted for the study of the fertilization in this order. The oogonia are very irregular in shape, appearing in some sections nearly triangular, and their average diameter is 45μ . The oospores are on an average about 36μ in diameter, with an endospore 3μ thick. The

exospore is thinner and yellowish-brown in color, and apparently somewhat papillate, but the markings are masked by those of the overlying oogonium wall, and as the specimens examined were not quite mature, it was difficult to free the oospores from the oogonia. The markings of the exospore are certainly much less prominent than in *C. candidus*.

As the oogonia and oospores differ decidedly from those of *C. cubicus*, called in recent works *C. Tragopogonis* (Pers.) Schroeter, the present form can not be included in that species, to which it was referred in 1874 in *Grevillea*, iii. 58, and where it is still placed in Saccardo's *Sylloge Fungorum*, vii. 234, 1888. In 1883 Zalewski in *Bot. Centralbl.*, xv. 223, under the name of *C. Convolvulacearum* Otth, described the oospores of the Cystopus on *Convolvulus Siculus* in Southern France, and on *C. retusus* in Guadeloupe, and referred the North American form on *Ipomœa Batatas* to the same species, although he had not seen oospores in the latter case; and Zalewski's name was adopted by Kellerman in *Trans. Kansas Acad. Sci.* x. 94, and by Ellis in *N. A. F.* no. 1809. Being unable to ascertain where the name cited by Zalewski was originally published by Otth, I applied for information to Dr. Ed. Fischer, of Berne, who kindly informed me that there were specimens in the Otth herbarium marked *C. Convolvuli* Otth on *C. Siculus* from Hyères, but that he was unable to find out when or where the species was published by Otth. Probably the name of Otth is a manuscript name, and we may regard Zalewski as the proper authority for the name *C. Convolvulacearum*, which name is not quoted in the *Sylloge* of 1888. The description of Zalewski makes no mention of the characteristic papillate oogonia, and his account of the markings of the oospores does not agree with those seen in Prof. Pammel's specimens, but when quite mature the latter might have become more distinctly marked.

Undoubtedly the first name given to the form on *Convolvulaceæ* in North America was *Æcidium Ipomœæ-panduranæ* Schweinitz, for an examination of an authentic specimen of Schweinitz shows that it is certainly a Cystopus identical, so far as can be told by the conidia, with the Cystopus known in this country on *Ipomœa Batatas* Lam., *I. Jalapa* Pursh., *I. pandurata* Meyer, *I. leptophylla* Torr., *I. commutata* Rœm. & Sch., *I. Nil* Roth., and *I. hederacea* Jacq. To this form is apparently also to be referred the Cystopus reported by me (*BOTANICAL GAZETTE*, viii. 335), as growing on cotton leaves in

Alabama. The leaves were sent to me as cotton leaves, to which they bear a strong resemblance, but a microscopic examination shows that they can not be cotton leaves, but probably leaves of some *Ipomœa* or *Convolvulus*. The date of the original Schweinitzian name is 1822, which must be prior to any name of Otth, even if I am mistaken in supposing the name cited by Zalewski to be merely an herbarium name of Otth. In 1834 Schweinitz in *Syn. Fung. Am. Bor.* no. 2866 changed his original name to *Cœoma Convolvulatum*, and in *Grevillea*, iii. 60, Berkeley and Curtis enumerated *Æcidium Ipomœæ* Schw. on *I. trichocarpa*, the same as *I. commutata* mentioned above. *Æcidium Ipomœæ* is apparently an abbreviation of the name in the *Syn. Fung. Car.* In the *Sylloge*, vii. 671, Berlese and De Toni give *Æcidium Ipomœæ-panduranæ* as a synonym of *Puccinia Ipomœæ* Cke., based on the specimen in Ravenel's *Fungi Americani*, no. 792. This is an error, for the æcidium in the specimen named is certainly not the true *Æc. Ipomœæ-panduranæ* of Schweinitz, but what is called by Cooke, in *Grevillea*, xiii. 6, *Æcidium Convolvuli* Schw. var. *Ipomœæ*.

In this connection it may be said that *Cystopus cubicus* has been found on *Matricaria* at San Diego by Mrs. Eigenmann, and on *Perityle Californica*, var. *nuda*, in Lower California. The last named specimens, received from Mr. Colville, contained ripe oospores.

Last autumn I received from Mr. K. Miyabe a very interesting *Peronospora*, found by Mr. Y. Tanaka on *Cucumis sativa* in the preceding June at Minoma, Tokio, Japan. The dried material received was accompanied by some excellent drawings, showing not only the conidia, but also illustrating the germination, which was by means of zoospores. The *Peronospora* hitherto known on *Cucurbitaceæ* in the United States is *P. australis* Speg., *P. sicyicola* Trelease of my previous paper. In the *Sylloge Fungorum* *P. australis* and *P. sicyicola* are described separately, but there can be no doubt that they are the same species, since not only does Spegazzini's excellent description answer to our plant, but specimens which were sent to him were pronounced by him to be certainly the same as the South American plant. The germination of the conidia of *P. australis* has not been seen, but the pinnate branching and condensed spiny tips of the conidiophores, and the general character of the spores are so much like those of such species as *P. viticola* and *P. Halstedii*, which are known to produce zoospores, that it might be supposed that it would also produce zoospores.

The same would not have been expected in the case of the Japanese *Peronospora*, for its aspect is unlike that of most of the zoosporiferous forms placed by Schroeter in the genus *Plasmopara*. The Japanese fungus is less conspicuous to the naked eye than *P. australis*, and covers scattered spots on the underside of the leaves with a thin down. The conidiophores are not densely tufted in the stomata, but are either solitary or grouped in small numbers. They have an average breadth of from $4-6\mu$ and generally reach a height of $25-30\mu$ before they begin to branch. The ramification is typically pinnate, the branches being given off at rather a wide angle, but not at right angles as in *P. viticola* and *P. Halstedii*. The main branches are again loosely once or twice pinnate with straight, filiform, widely diverging tips. Occasionally there is an appearance of forking, owing to the exceptionally luxuriant growth of the lower branches, but the typical branching is certainly pinnate rather than dichotomous. Compared with the conidiophores of other species the present form is marked by its slender naked main axis bearing a loose tuft of branches near the tip. The spores are obtusely oval, from $21-25\mu$ long by $15-18\mu$ broad, 25μ by 18μ being very common. They are slightly papillate and, when mature, of a dingy violet color. Oospores were not seen by me. The species is said to occur in Japan on one other cucurbitaceous plant besides *Cucumis sativus*, but I am unable to give the name of the second host.

Mr. Miyabe has fortunately been able recently to examine the specimens of *Peronospora Cubensis* B. & C. in the Berkeley collection at Kew, and finds that the Japanese fungus is identical with that species. The species is interesting biologically because, as a rule, the conidial spores of those *Peronosporæ* which produce zoospores are small and cuboidal in shape, while the large oval and violet colored spores of the present species suggest rather species placed by de Bary in the section *Pleuroblastæ*. The range of the species is also interesting. Found first in Cuba by C. Wright, it has not been seen again until discovered in Japan in 1888, and during the present year in New Jersey, where it was found by Professor Halsted on cucumbers. The latter specimens agree perfectly with those from Japan, and Professor Halsted informs me that he has also been able to see the germination of the conidial spores by zoospores, thus confirming the observations made in Japan by Mr. Tanaka.

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